

CLAIMS

What is claimed is:

1. A spinal fixation device comprising:
 - 5 first and second securing members each having a threaded shaft member configured to be inserted into designated entry points of two respective and adjacent vertebrae, each securing member having a coupling assembly for receiving and securing respective end portions of a connection unit therein; and
 - a flexible connection unit having a first end portion configured to be received and
 - 10 secured within the coupling assembly of the first securing member and a second end portion configured to be received and secured within the coupling assembly of the second securing member, wherein the flexible connection unit comprises a metal tube having a spiral groove formed along at least a portion of its tubular body so as to provide flexibility to the connection unit.
- 15 2. The spinal fixation device of claim 1 wherein said first and second end portions are configured as rod-like connection members and said respective coupling assemblies are configured to receive and secure said first and second end portions.
- 20 3. The spinal fixation device of claim 1 wherein said first and second end portions are configured as plate-like connection members and said respective coupling assemblies are configured to receive and secure said first and second end portions.
- 25 4. The spinal fixation device of claim 1 wherein said first end portion is configured as a rod-like connection member and said second end portion is configured as a plate-like connection member and said coupling assembly of said first securing member is configured to receive and secure said first end portion and said coupling assembly of said

second securing member is configured to receive and secure said second end portion.

5 5. The spinal fixation device of claim 1 wherein said flexible connection unit comprises a flexible middle portion interposed between two rigid portions, wherein the flexible middle portion comprises said portion of the tubular body of the metal tube having said spiral grooves therein.

10 6. The spinal fixation device of claim 1 wherein said flexible connection unit is formed in a pre-bent configuration.

15 7. The spinal fixation device of claim 1 wherein said first and second securing members are pedicle screws and said respective coupling assemblies each comprise a slanted seat for receiving an end portion of said flexible connection unit at an angle θ and a slanted spacer configured to firmly secure the end portion of the flexible connection unit against the slanted seat.

20 8. A spinal fixation device, comprising:
first and second securing members each having a threaded shaft member configured to be inserted into designated entry points of two respective and adjacent vertebrae, each securing member further having a coupling assembly for receiving and securing respective end portions of a connection unit therein; and

25 a flexible connection unit having a first end portion configured to be received and secured within the coupling assembly of the first securing member and a second end portion configured to be received and secured within the coupling assembly of the second securing member, wherein the flexible connection unit comprises at least one metal wire comprising a plurality of metal yarns to provide flexibility to the connection unit.

9. The spinal fixation device of claim 8 wherein said first and second end portions are configured as rod-like connection members and said respective coupling assemblies are configured to receive and secure said first and second end portions.
- 5 10. The spinal fixation device of claim 8 wherein said first and second end portions are configured as plate-like connection members and said respective coupling assemblies are configured to receive and secure said first and second end portions.
- 10 11. The spinal fixation device of claim 8 wherein said first end portion is configured as a rod-like connection member and said second end portion is configured as a plate-like connection member and said coupling assembly of said first securing member is configured to receive and secure said first end portion and said coupling assembly of said second securing member is configured to receive and secure said second end portion.
- 15 12. The spinal fixation device of claim 8 wherein said flexible connection unit comprises a flexible middle portion interposed between two rigid portions, wherein the flexible middle portion comprises said metal wire.
- 20 13. The spinal fixation device of claim 8 wherein said flexible connection unit is formed in a pre-bent configuration.
- 25 14. The spinal fixation device of claim 8 wherein said first and second securing members are pedicle screws and said respective coupling assemblies each comprise a slanted seat for receiving an end portion of said flexible connection unit at an angle θ and a slanted spacer configured to firmly secure the end portion of the flexible connection unit against the slanted seat.

15. The spinal fixation device of claim 8 wherein said flexible connection unit comprises a plurality of metal wires interwoven in a braided structure to provide a desired level of flexibility to said flexible connection unit.

5 16. The spinal fixation device of claim 15 wherein said flexible connection unit comprises a flexible middle portion interposed between two rigid portions, wherein the flexible middle portion comprises said plurality of metal wires interwoven in a braided structure.

10 17. A spinal fixation device, comprising:

first and second securing members each having a threaded shaft member configured to be inserted into designated entry points of two respective and adjacent vertebrae, each securing member further having a coupling assembly for receiving and securing respective end portions of a connection unit therein; and

15 a flexible connection unit having a first end portion configured to be received and secured within the coupling assembly of the first securing member and a second end portion configured to be received and secured within the coupling assembly of the second securing member, wherein the flexible connection unit comprises at least one metal spacer interposed between the first and second end portions and a flexible metal material located
20 in a longitudinal axial channel of the at least one metal spacer to provide flexibility to the flexible connection unit.

18. The spinal fixation device of claim 17 wherein said at least one metal spacer further comprises a male interlocking member and a female interlocking cavity each
25 configured to structurally interlock with respective adjacent metal spacers or end portions having a corresponding female interlocking cavity and male interlocking member, respectively.

19. The spinal fixation device of claim 17 wherein said flexible metal material comprises a metal wire comprising a plurality of metal yarns.

5 20. The spinal fixation device of claim 17 wherein said flexible metal material comprises a braided metal wire structure comprising a plurality of interwoven metal wires.

21. The spinal fixation device of claim 17 wherein said first and second end portions are configured as rod-like connection members and said respective coupling assemblies
10 are configured to receive and secure said first and second end portions.

22. The spinal fixation device of claim 17 wherein said first and second end portions are configured as plate-like connection members and said respective coupling assemblies are configured to receive and secure said first and second end portions.

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23. The spinal fixation device of claim 17 wherein said first end portion is configured as a rod-like connection member and said second end portion is configured as a plate-like connection member and said coupling assembly of said first securing member is configured to receive and secure said first end portion and said coupling assembly of said
20 second securing member is configured to receive and secure said second end portion.

24. A flexible metal connection unit for use in a spinal fixation device, comprising a first metal tube having a spiral groove formed along at least a portion of its tubular body so as to provide flexibility to the connection unit

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25. The flexible metal connection unit of claim 24 further comprising a second metal tube having a smaller diameter than said first metal tube such that the second metal tube is

configured to fit inside a longitudinal axial channel of the first metal tube, wherein said second metal tube comprises a second spiral groove formed along at least a portion of its tubular body.

5 26. The flexible metal connection unit of claim 24 further comprising a metal wire comprising a plurality of metal yarns, wherein said metal wire is configured to fit inside a longitudinal axial channel of said first metal tube.

27. The flexible metal connection unit of claim 24 further comprising a braided metal
10 wire structure comprising a plurality of interwoven metal wires, wherein said braided metal wire structure is configured to fit inside a longitudinal axial channel of said first metal tube.

28. The flexible metal connection unit of claim 24 further comprising a flexible core
15 material located within a longitudinal axial channel of said first metal tube.

29. The flexible connection unit of claim 28 wherein said flexible core material consists of at least one of the following: carbon graphite, PEEK, PEEKKEK, NITINOL, UHMWPE.

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30. The flexible connection unit of claim 24 further comprising a flexible middle portion interposed between two rigid portions, wherein the flexible middle portion comprises said portion of the tubular body of the metal tube having said spiral grooves therein.

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31. The flexible connection unit of claim 24 wherein said flexible connection unit is formed in a pre-bent configuration.

32. A flexible connection unit for use in a spinal fixation device, comprising at least one metal wire having a plurality of metal yarns wherein the material, thickness and number of yarns determines a level of flexibility of the flexible connection unit.

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33. The flexible connection unit of claim 32 further comprising a flexible middle portion interposed between to rigid portions, wherein the flexible middle portion comprises said metal wire.

10 34. The flexible connection unit of claim 32 wherein said flexible connection unit is formed in a pre-bent configuration.

35. A flexible connection unit for use in a spinal fixation device comprising a braided metal structure.

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36. The flexible connection unit of claim 35 wherein said braided structure comprises a plurality of metal wires interwoven in a braided fashion to provide a desired level of flexibility to said flexible connection unit.

20 37. The flexible connection unit of claim 36 further comprising a flexible middle portion interposed between to rigid portions, wherein the flexible middle portion comprises said plurality of metal wires interwoven in a braided structure.

25 38. The flexible connection unit of claim 35 wherein said flexible connection unit is formed in a pre-bent configuration.

39. A flexible connection unit for use in a spinal fixation device, comprising at least

one metal spacer interposed between two end portions and a flexible metal material located in a longitudinal axial channel of the at least one metal spacer to provide flexibility to the flexible connection unit.

5 40. The flexible connection unit of claim 39 wherein said at least one metal spacer further comprises a male interlocking member and a female interlocking cavity each configured to structurally interlock with respective adjacent metal spacers or end portions having a corresponding female interlocking cavity and male interlocking member, respectively.

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41. The flexible connection unit of claim 39 wherein said flexible metal material comprises a metal wire comprising a plurality of metal yarns.

15 42. The flexible connection unit of claim 39 wherein said flexible metal material comprises a braided metal wire structure comprising a plurality of interwoven metal wires.

20 43. A pedicle screw for use in a spinal fixation device, comprising a threaded shaft portion configured to be inserted and secured to a pedicle bone of a spinal column, a coupling assembly connected to a top end of the threaded shaft portion, wherein the coupling assembly comprises a slanted seat for receiving an end portion of said flexible connection unit at an angle θ and a slanted spacer configured to firmly secure the end portion of the flexible connection unit against the slanted seat.